PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Hidetoshi YOKOTA, et al.

PCT Appln. No.: PCT/JP01/05298

Confirmation No.: Not Yet Assigned

Group Art Unit: Not Yet Assigned

Filed: February 13, 2002

Examiner: Not Yet Assigned

For: VEHICLE RUNNING STATE ESTIMATION METHOD AND APPARATUS, VEHICLE CONTROL APPARATUS AND TIRE WHEEL

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE CLAIMS:

Please enter the following amended claims:

12. The vehicle running state estimation apparatus according to claim 8, wherein the relationship between road surface friction coefficient μ obtained from the braking distances of a vehicle under various road conditions at different speeds and the vibration level at a predetermined frequency band, the computed value of vibration level or vibration transmission level is obtained previously and the road surface friction coefficient μ at the time of running is estimated based on the relationship.

13. The vehicle running state estimation apparatus according to claim 8, wherein the frequency band is a band including the frequency of natural vibration of a tire tread land portion.

14. The vehicle running state estimation apparatus according to claim 8, wherein a threshold value is set for the vibration level and the surface of a road is estimated to be in a low friction condition when the calculated vibration level exceeds the threshold value.

16. The vehicle running state estimation apparatus according to claim 6 which further comprises vehicle speed detection means to estimate the condition of a road surface based on vehicle speed.

17. A vehicle running state estimation apparatus comprising the vehicle running state estimation apparatus of claim 6, means of judging the slipperiness of a road surface based on the condition of the road surface estimated by the road surface condition estimation means and warning means for giving a warning when it is judged that the condition of the road surface is slippery.

25. The vehicle running state estimation apparatus according to claim 6 which further comprises a transmitter for transmitting the output of the vibration detection means for calculating a time change in vibration level or a vibration level at a predetermined frequency band.

26. The vehicle running state estimation apparatus according to claim 6 further comprising a power generating unit which is mounted to a tire wheel, generates power by the rolling of each tire and supplies power for driving the vibration detection means or power for amplifying the output of the vibration detection means.

27. A vehicle control apparatus comprising vehicle control means for controlling the running state of a vehicle based on the condition of a road surface estimated by the vehicle running state estimation apparatus of claim 6 and/or the running state of each tire.

29. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the locked state of each wheel.

30. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the attitude of a vehicle.

31. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the air pressure of each tire.

32. The vehicle control apparatus according to claim 27, wherein the vehicle control means controls the idling state of each wheel.

33. The vehicle control apparatus according to claim 27, wherein the vehicle control means changes the inter-vehicle distance set value of an automatic driving system.

34. A tire wheel comprising the vehicle running state estimation apparatus for estimating the running state of a vehicle by detecting the vibration level of a portion below the spring of a running vehicle as set forth in claim 6 and a power generating unit for generating power by the rolling of each tire and supplying power to the vehicle running state estimation apparatus.

36. The tire wheel according to claim 34, wherein the power generating unit comprises a rotor magnetized and rotated by the rolling of each tire, a stator made from a high magnetic permeability material and adjacent to the rotor and a power generating coil installed within a magnetic circuit including the rotor and the stator.

38. The tire wheel according to claim 36, wherein the rotor is turned by rotating an unbalance weight the gravity center of the rotary cone of which is eccentric to a rotary shaft by the rolling of each tire.

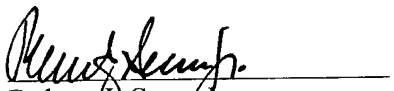
39. The tire wheel according to claim 36, wherein an air stream generated by the rolling of each tire is introduced into the power generating unit and the rotor is turned by the introduced air stream.

PRELIMINARY AMENDMENT
PCT Appln. No.: PCT/JP01/05298

REMARKS

Entry and consideration of this Amendment is respectfully requested.

Respectfully submitted,



Robert J. Seas, Jr.
Registration No. 21,092

SUGHRUE MION, PLLC
2100 Pennsylvania Avenue, N.W.
Washington, D.C. 20037-3213
Telephone: (202) 293-7060
Facsimile: (202) 293-7860
RJS/rwl
Date: February 13, 2002

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

12. The vehicle running state estimation apparatus according to claim ~~any one of claims 8 to 11~~, wherein the relationship between road surface friction coefficient μ obtained from the braking distances of a vehicle under various road conditions at different speeds and the vibration level at a predetermined frequency band, the computed value of vibration level or vibration transmission level is obtained previously and the road surface friction coefficient μ at the time of running is estimated based on the relationship.

13. The vehicle running state estimation apparatus according to claim~~any one of claims 8 to 12~~, wherein the frequency band is a band including the frequency of natural vibration of a tire tread land portion.

14. The vehicle running state estimation apparatus according to claim ~~any one of claims 8 to 13~~, wherein a threshold value is set for the vibration level and the surface of a road is estimated to be in a low friction condition when the calculated vibration level exceeds the threshold value.

16. The vehicle running state estimation apparatus according to claim ~~any one of claims 6 to 15~~ which further comprises vehicle speed detection means to estimate the condition of a road surface based on vehicle speed.

17. A vehicle running state estimation apparatus comprising the vehicle running state estimation apparatus of ~~any one of claims~~claim ~~6 to 16~~, means of judging the slipperiness of a road surface based on the condition of the road surface estimated by the road surface condition

estimation means and warning means for giving a warning when it is judged that the condition of the road surface is slippery.

25. The vehicle running state estimation apparatus according to claim~~any one of claims~~ 6 ~~to~~ ~~24~~ which further comprises a transmitter for transmitting the output of the vibration detection means for calculating a time change in vibration level or a vibration level at a predetermined frequency band.

26. The vehicle running state estimation apparatus according to claim~~any one of claims~~ 6 ~~to~~ ~~25~~ further comprising a power generating unit which is mounted to a tire wheel, generates power by the rolling of each tire and supplies power for driving the vibration detection means or power for amplifying the output of the vibration detection means.

27. A vehicle control apparatus comprising vehicle control means for controlling the running state of a vehicle based on the condition of a road surface estimated by the vehicle running state estimation apparatus of ~~any one of claims~~claim ~~6 to 26~~ and/or the running state of each tire.

29. The vehicle control apparatus according to claim 27 ~~or 28~~, wherein the vehicle control means controls the locked state of each wheel.

30. The vehicle control apparatus according to claim 27 ~~or 28~~, wherein the vehicle control means controls the attitude of a vehicle.

31. The vehicle control apparatus according to claim 27 ~~or 28~~, wherein the vehicle control means controls the air pressure of each tire.

32. The vehicle control apparatus according to claim 27 ~~or 28~~, wherein the vehicle control means controls the idling state of each wheel.

33. The vehicle control apparatus according to claim 27~~ or 28~~, wherein the vehicle control means changes the inter-vehicle distance set value of an automatic driving system.

34. A tire wheel comprising the vehicle running state estimation apparatus for estimating the running state of a vehicle by detecting the vibration level of a portion below the spring of a running vehicle as set forth in claim~~claims~~ 6 ~~to 26~~ and a power generating unit for generating power by the rolling of each tire and supplying power to the vehicle running state estimation apparatus.

36. The tire wheel according to claim 34~~ or 35~~, wherein the power generating unit comprises a rotor magnetized and rotated by the rolling of each tire, a stator made from a high magnetic permeability material and adjacent to the rotor and a power generating coil installed within a magnetic circuit including the rotor and the stator.

38. The tire wheel according to claim 36~~ or 37~~, wherein the rotor is turned by rotating an unbalance weight the gravity center of the rotary cone of which is eccentric to a rotary shaft by the rolling of each tire.

39. The tire wheel according to claim 36~~ or 37~~, wherein an air stream generated by the rolling of each tire is introduced into the power generating unit and the rotor is turned by the introduced air stream.